The changing dynamics of maternal nutrition in urban Nepal: preliminary findings from a longitudinal study in Bhaktapur

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Background:

Nepal is undergoing a nutrition transition in which overweight and obesity are becoming issues of increasing public health concern, and coexist with undernutrition.[1,2] An analysis of the Demographic and Health Surveys (DHS) in Nepal from 1996 to 2006 found more than a four-fold increase in the prevalence of overweight (BMI>25.0 kg/m^2) among reproductive aged-women nationally, from 1.6% to 10.1%.[3] Among urban women, the prevalence of overweight increased from 5.8% to 25.5% over the same 10 year period although little change was evident from 2001 to 2006 (during which the prevalence changed from 24.0% to 25.5%).[3] Recent review papers have highlighted the need for more evidence to understand the evolution of the rise in overweight/obesity in different sub-populations within Nepal and particularly to understand preventable risk factors associated with overweight and obesity.[2]

Bhaktapur municipality is a peri-urban area consisting of approximately 80,000 inhabitants and is one of the three main urban areas in the Kathmandu valley. While the traditional residents of Bhaktapur are of *Newari* origin, the ethnic composition of the area is changing with migration from the rural areas. The area is densely populated and consists of a mix of farmers, semi-skilled and unskilled laborers and daily wage earners. Shifting livelihoods and diets in urban areas such as Bhaktapur have uncertain implications for the nutrition transition, and little evidence exists to document trends in nutritional status of the population. We undertook a cohort study to track a group of women and children over a five-year period to examine associations between women's diet and the nutritional status of women and children over time.

Methods:

In 2007-2008 a representative survey was undertaken among 500 healthy lactating women (ages 17-44 years) and their infants, randomly selected from the catchment area of Siddhi Memorial Children's Hospital in Bhaktapur municipality, Nepal. Mother-infant pairs received physical examinations including blood sampling, administration of a socio-demographic questionnaire, collection of dietary information using three 24-hour recalls, and anthropometric measures. A UNICEF weighing scale (SECA, Germany) was used to collect measurements of the weight of women, and height was measured using calibrated locally made boards. Maternal body mass index (BMI) was calculated as kg/m^2. BMI<18.5 was considered underweight while 18.5≤BMI<25 was considered normal weight, and BMI ≥25 overweight. Three detailed 24 hour recalls were used to collect information about diet. Five years later (2012-13), women and their children were followed up—this preliminary report analysis is of the first 270 women we identified, of which 257 were non-pregnant. We compare these findings against baseline data from the same 270 women.

All women gave informed consent before start of the study, which was approved by The Nepal Health Research Council in Kathmandu. Approval for this analysis was also granted by the institutional review board of the Harvard School of Public Health and the Norwegian Research Committee for Medical and Health Research Ethics.

Results:

The follow-up survey conducted in 2012-13 included more extensive information about the socioeconomic status of households than the baseline survey (which was largely focused on the collection of dietary information.) Trends in the proportion of women renting vs. owning a house and living in a single room suggest that there was an improvement in the socioeconomic status of some households in the sample (**Table 1**). Despite being a peri-urban population, the majority of households on agricultural land, and ¾ of households planted rice the previous year.

Table 1: Basic characteristics of the population at baseline (2006-7)

	2007-2008 (n=270)	2012-2013 (n=270)
Mean age (SD)	25.9 (4.0)	30.5 (4.3)
% Renting house	32%	21%
% Living in single room	33%	23%
Own refrigerator (%)	-	21%
Own agricultural land (%)	-	64%
Planted rice in previous year (%)	-	75%

Five years after the original survey, the prevalence of overweight among the women increased markedly—from 17% to 41% (Table 2). The prevalence of low body mass index (<18.5), which affected only 4% of women at baseline decreased to 2%.

Table 2: Maternal body mass index, underweight and overweight at baseline and follow-up

	2007-2008 (n=270)	2012-2013 (n=257)
Mean BMI (SD) kg/m^2	22.5 (3.0)	24.3 (3.5)
BMI category		
Underweight <18.5 kg/m^2	4 %	2%
18.5≤BMI≤25 kg/m^2	79%	57%
Overweight >25 kg/m^2	17%	41%

In apparent contrast to the increase observed in maternal overweight, the prevalence of women with anemia (defined using both non altitude adjusted and altitude adjusted thresholds), increased in this population while mean hemoglobin slightly declined.

Table 3: Maternal hemoglobin and anemia at baseline and follow-up

	2007-2008 (n=270)	2012-2013 (n=257)
Mean Hb, g/dL	13.2 (1.1)	12.6 (1.4)
Hemoglobin category		
<12 g/dL	8%	29%
<12.3 g/dL*	17%	41%
<10 g/dL	0.4%	0.7%

*(altitude adjusted threshold)

Discussion:

Like many other urban populations in South Asia, the adult population living in Bhaktapur is experiencing the double burden of both undernutrition (primarily in the form of micronutrient deficiencies) and overnutrition in the form of overweight. Among women, undernutrition appears to largely take the form of anemia in the form of micronutrient deficiencies. Future work will explore the extent of the double burden among children.

The rise in the prevalence of anemia over time is likely to be at least partially explained by the fact that during the baseline survey many women were still taking or had recently discontinued taking iron supplements. Analysis of the nutritional and other factors contributing to anemia in the baseline survey is ongoing and will be reported shortly.

Over the course of a five-year period we observed more than a two-fold increase in the risk of overweight among a cohort of women. The overweight prevalence of 41% was higher than that of 27% previously reported in the 2011 DHS (although the average age of women in our cohort is also older).

It is important to consider the potential role of selection bias in explaining these preliminary findings. At the time data was analyzed we had not yet followed up the entire cohort, and these findings represent only about half of the original women included in the baseline survey. In order to explore whether selection bias towards better off households might be responsible for the trend we observed, we compared the baseline characteristics of women included in this analysis vs. the full sample and found only slight differences in the prevalence of overweight and other factors. These findings suggest that selection bias is unlikely to be the main cause of the increase in overweight, but the final analysis on the full dataset will use more sophisticated methods to explore the possibility of selection bias.

Little is known about the dietary and nondietary factors underlying the increase in the prevalence of overweight in Nepal—at present, much of the information linking shifting diet to changes in obesity come from food balance sheets which are subject to ecological fallacy.[4] Our dataset contains extensive data on women's diet at both points in time and will enable us to help characterize how diets may have changed over the past five years, and how dietary patterns may be linked to risk of overweight. We are in the process of analyzing associations between diet, lifestyle factors, and risk of overweight to better understand dynamics contributing to this growing trend in Nepal which we are planning on disseminating through both peer reviewed publications and future briefs.

Conclusions:

Data from our cohort in Bhaktapur suggests that overweight and obesity is rapidly rising among adults in Nepal. More efforts are needed to track the burden of overnutrition in different sub-populations and to identify modifiable risk factors associated with this change. Nutrition and agricultural policies in Nepal should take into account both under and overnutrition.

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